COVALENT BONDING GEOMETRY AND POLARITY

IB Chemistry

Topic 04 - Bonding

Molecular Interactions

- Inter-molecular Forces
  - Interaction between molecules that hold it together in a network.
- Intra-molecular Forces
  - Forces that hold groups of atoms together and make them function as a unit

Intra-molecular Forces: Bonding

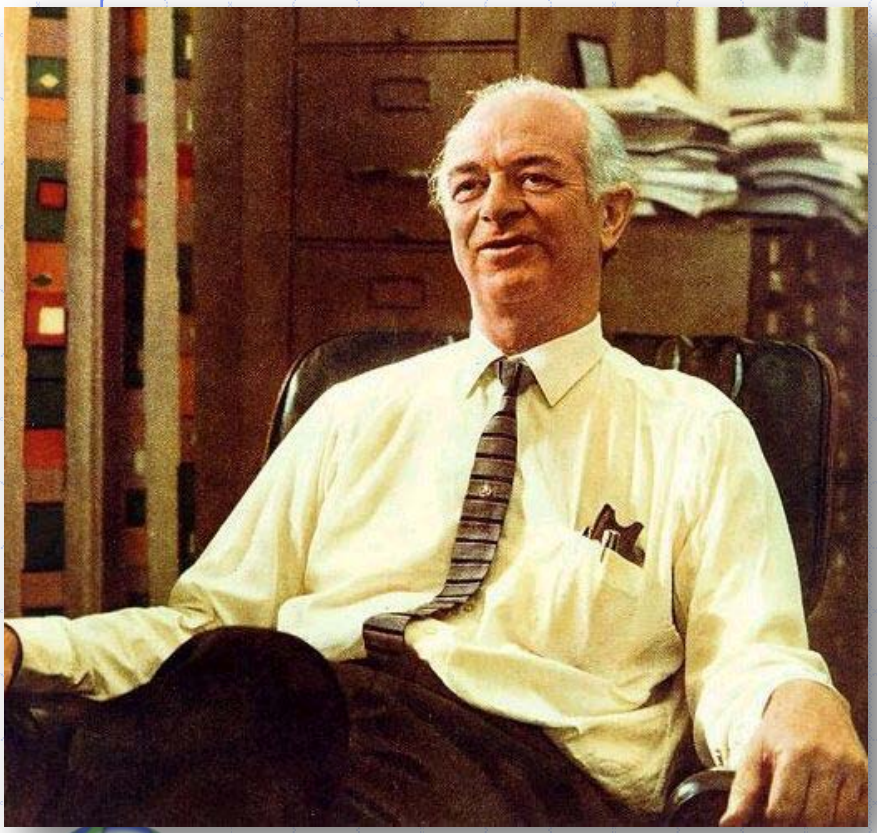
- Forces that hold groups of atoms together and make them function as a unit.
  - Ionic bonds – transfer of electrons
  - Covalent bonds – sharing of electrons
  - Metallic Bonding – sea of electrons
  - Network Covalent – diamond graphite

Review: Why do atoms bond?

- To satisfy the octet rule?
  - Yes, but to be more specific, atoms share electrons in order to complete their outer electron shell making them more stable as they are then in a lower state of energy.
- But how do we know what type of bonding will occur between two atoms?

Bonding - Ionic or Covalent

How can we determine how two elements will form a bond?

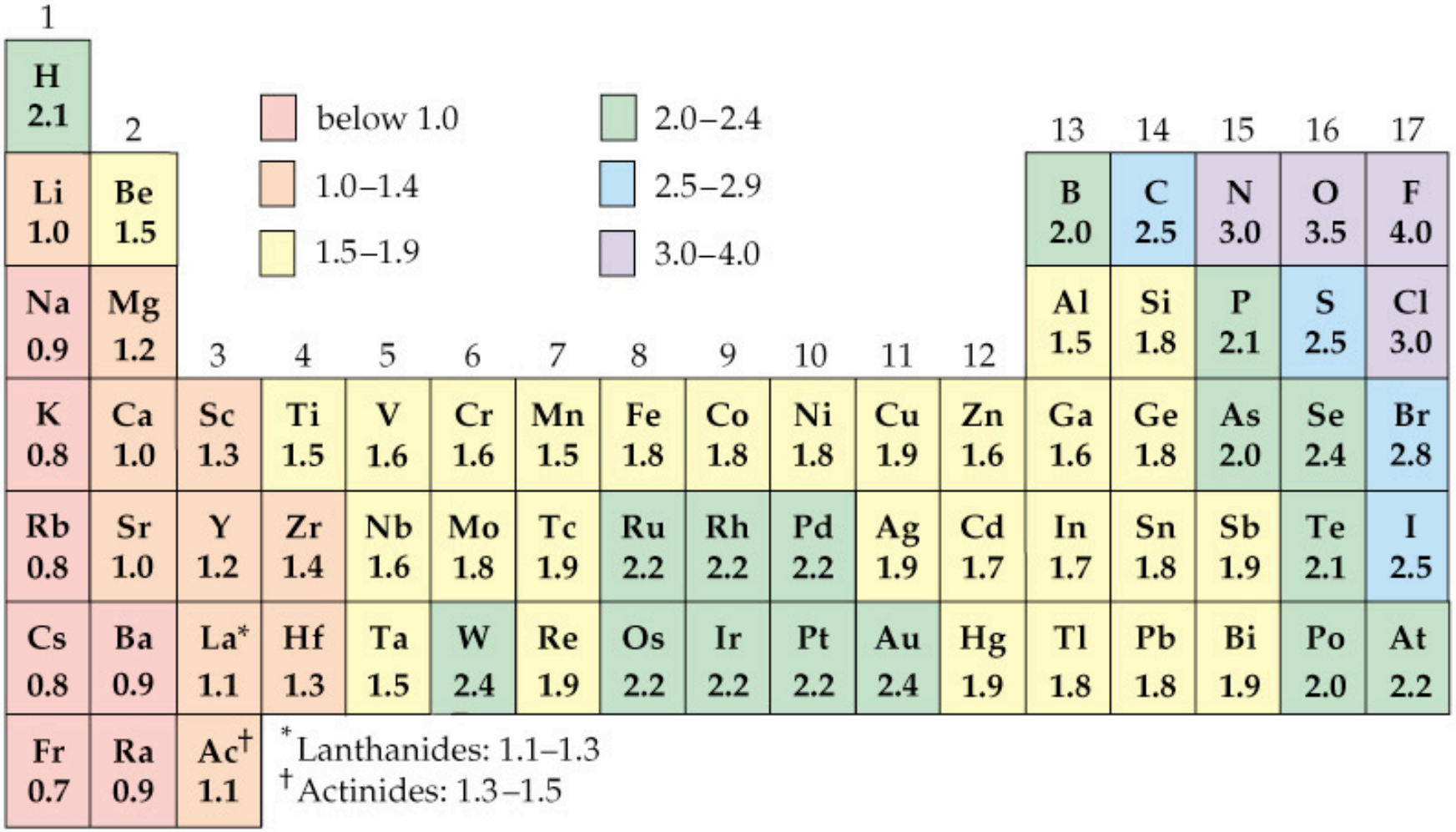


Linus Pauling
1901 - 1994

Electronegativity

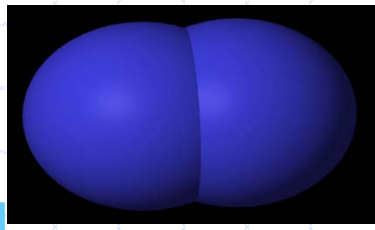
The ability or affinity of an atom to attract toward itself the electrons in a chemical bond.

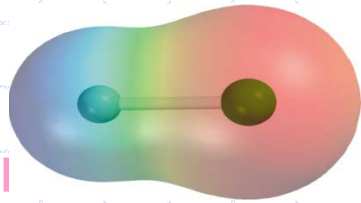
Table of Electronegativities



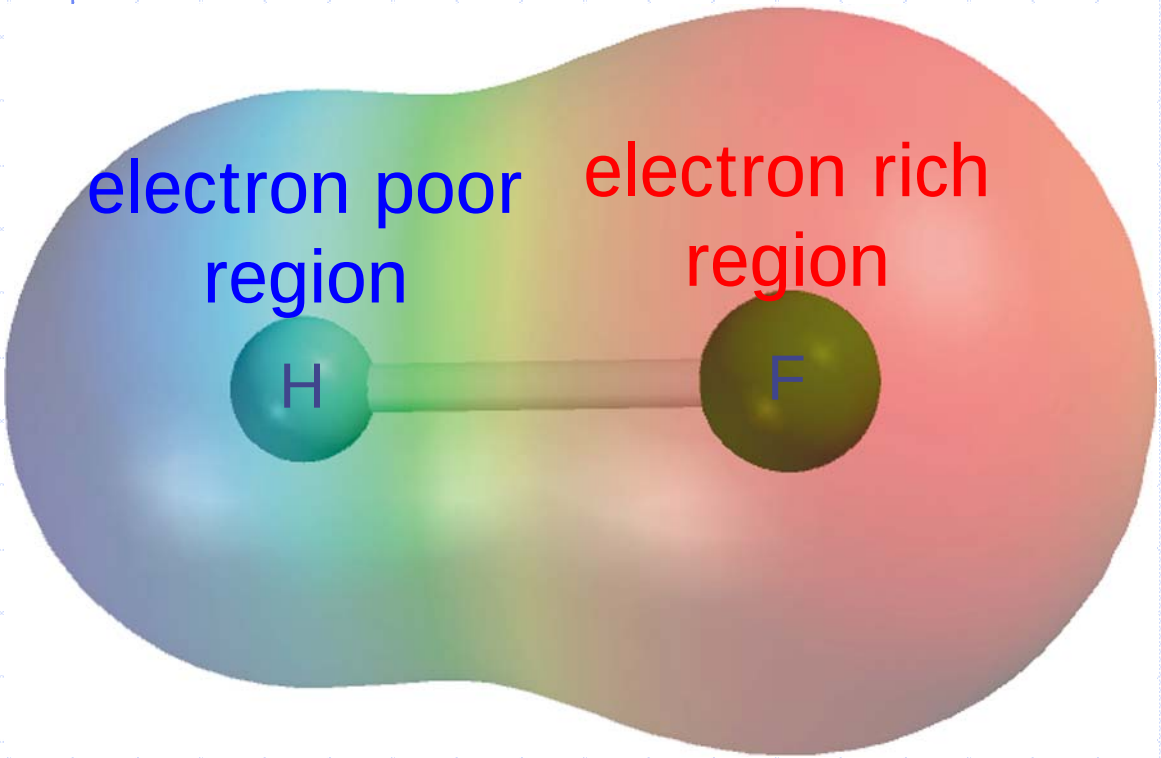
Determination of Bond Type

- Rough range difference in electronegativity
  - 0 - 0.4 : Non-Polar Covalent
    - Even sharing of electrons within a bond
  - 0.4 - 2.0 : Polar Covalent
    - Uneven sharing of electrons within a bo
  - 2.0 – 4.0 : Ionic
    - Stealing or transfer of electrons





Polar or Non-Polar?

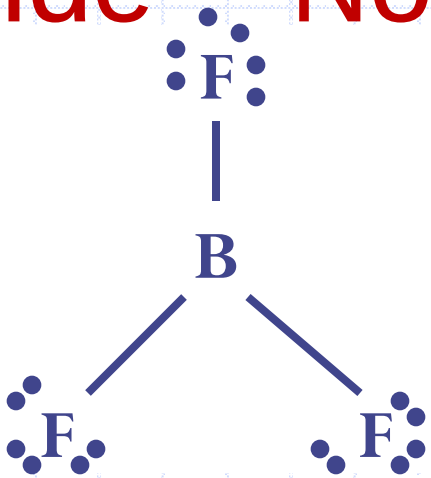


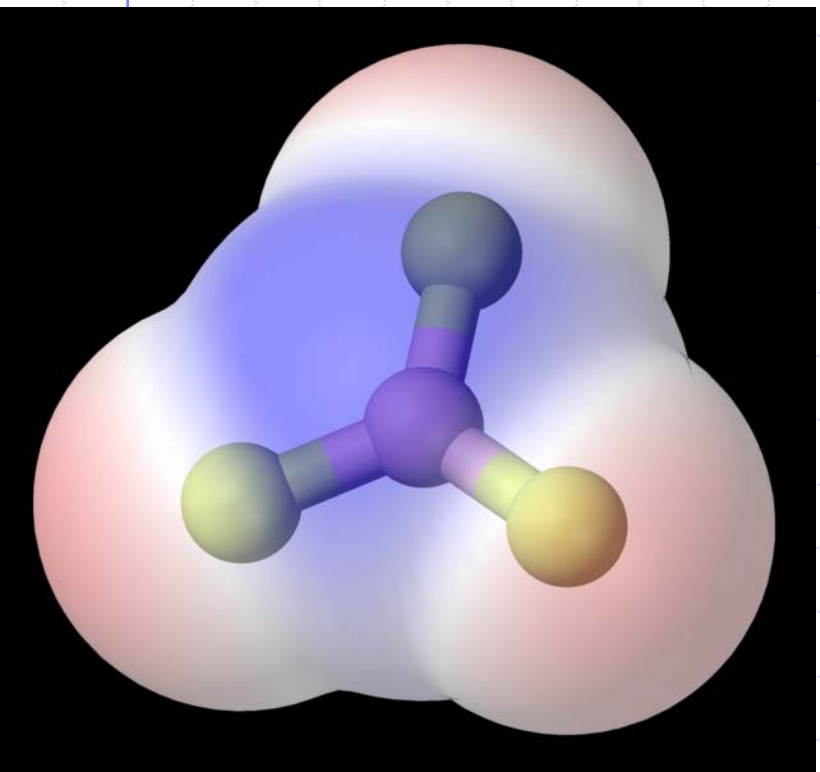
e^- poor e^- rich

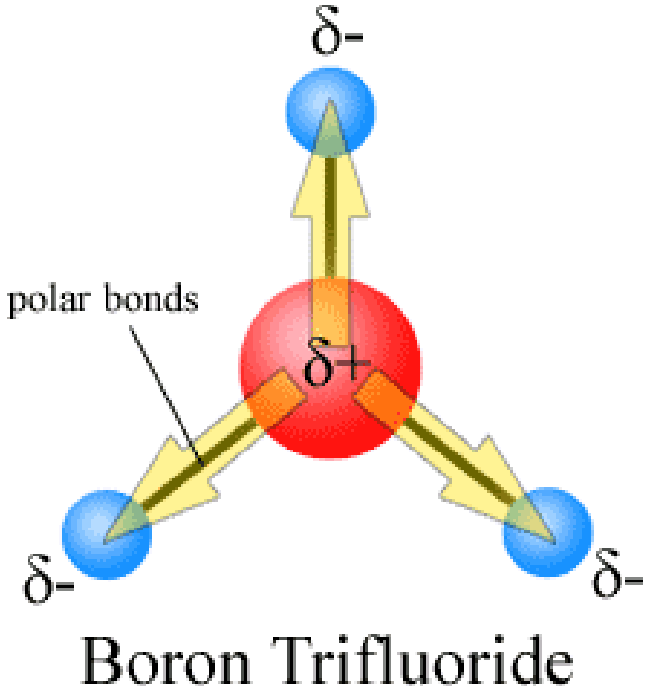
H—F

∂^+ ∂^-

Boron Trifluoride – Non-Polar (even)

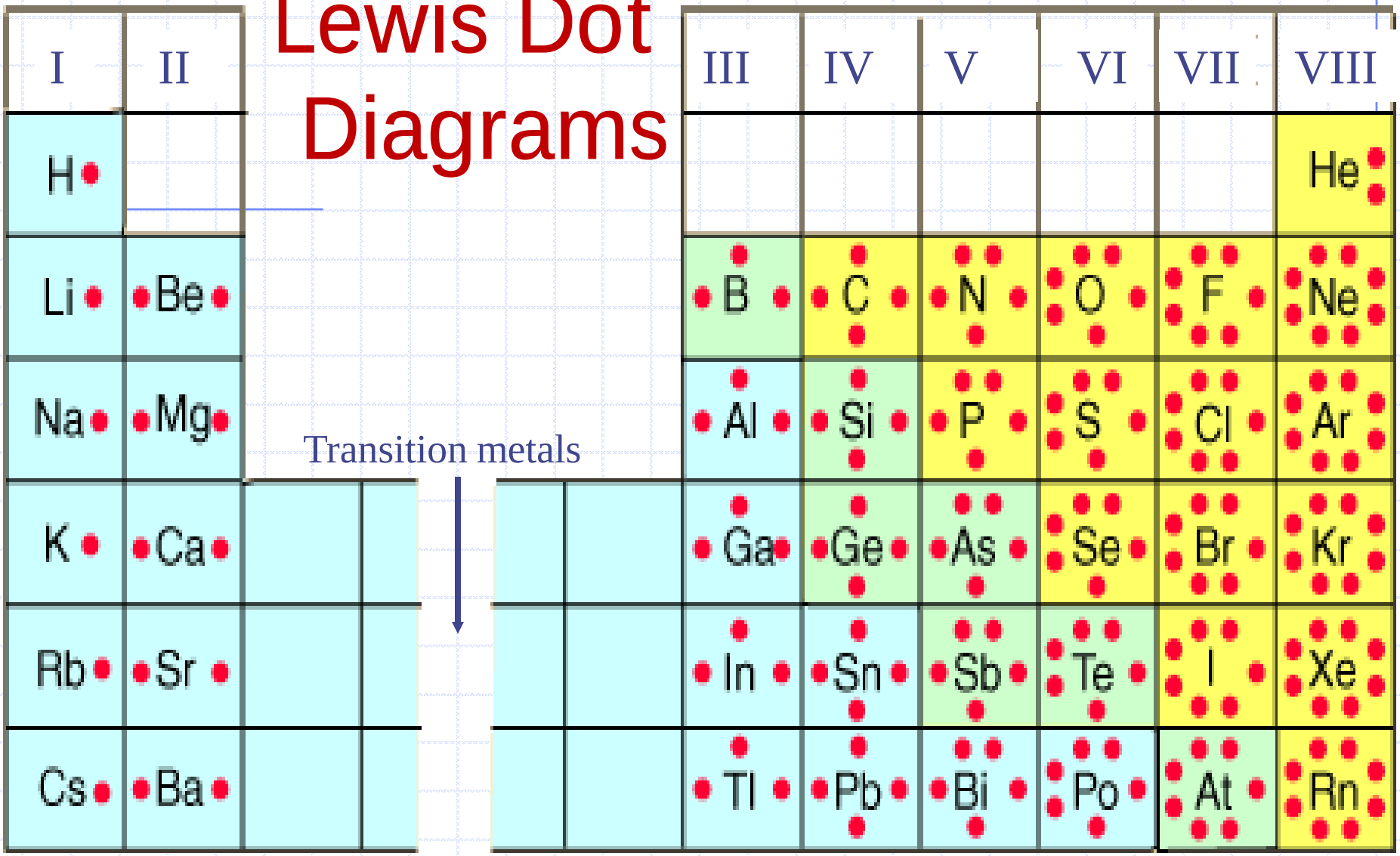






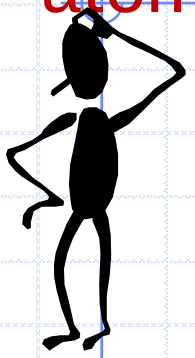
Boron Trifluoride

Lewis Dot Diagrams

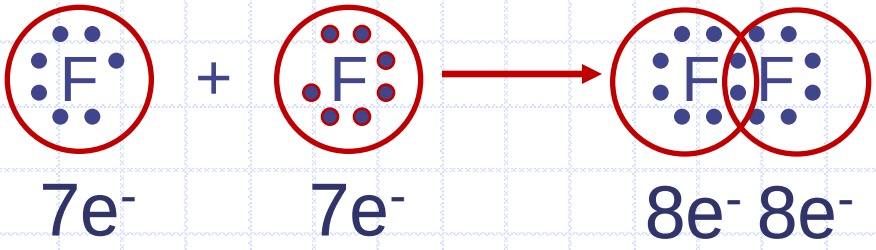


- Lewis Dot Diagrams are used in both ionic and covalent bonding

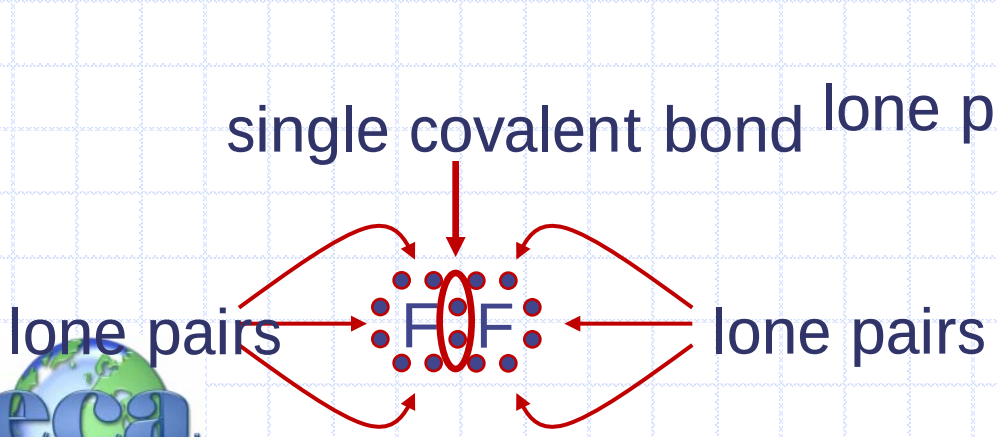
A ***covalent/molecular bond*** is a chemical bond in which two or more electrons are shared by two atoms.

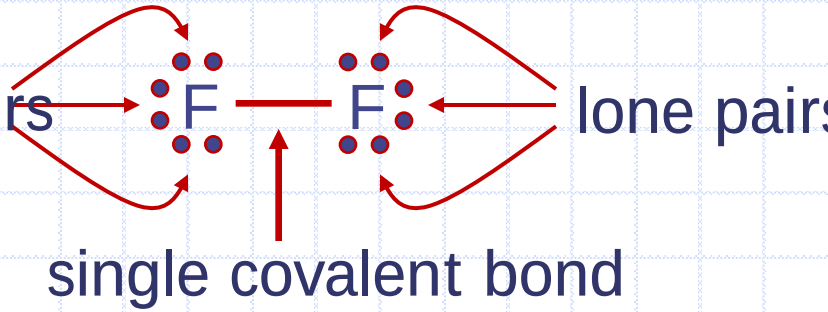


Why should two atoms share electrons?

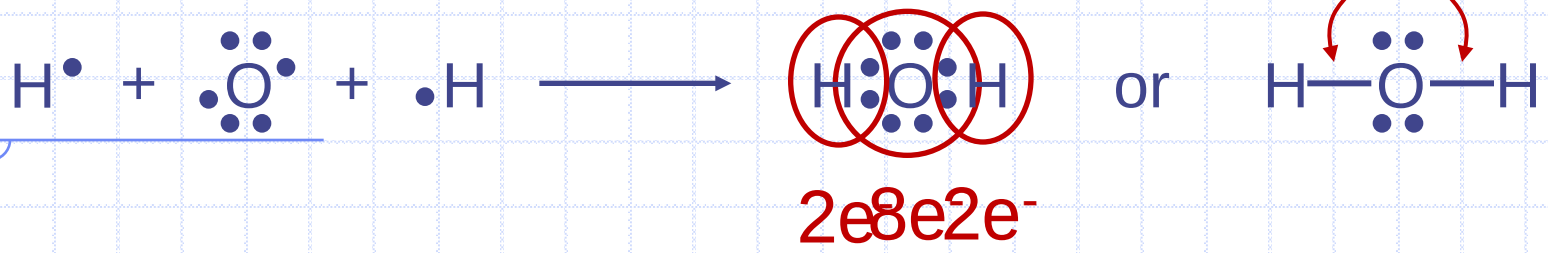


Lewis structure of F_2

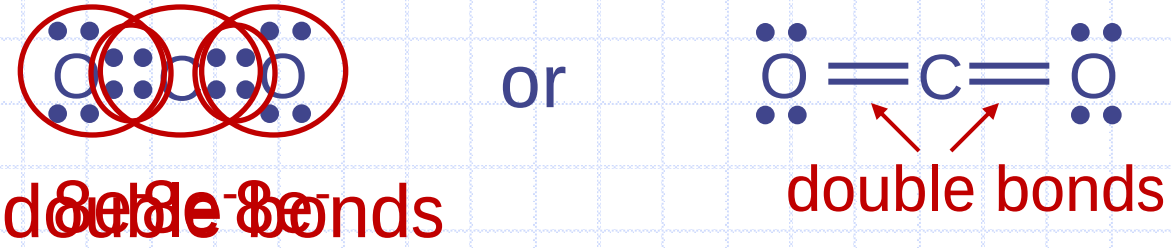




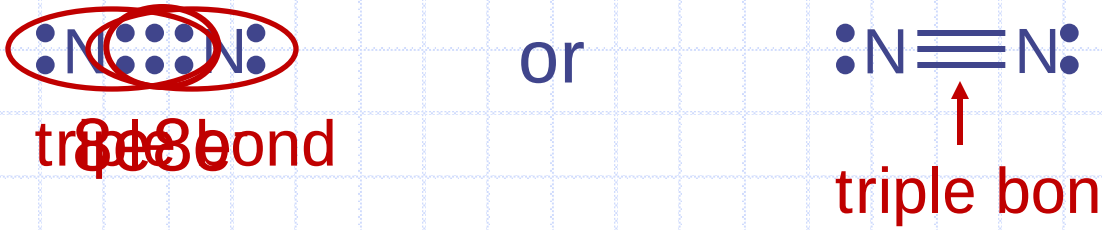
Lewis structure of water



Double bond – two atoms share two pairs of electron



Triple bond – two atoms share three pairs of electron



Review.....

- Explain intra/inter molecular bonding, the difference between covalent/ionic bonds, how you determine bonding type, and types of bonds:

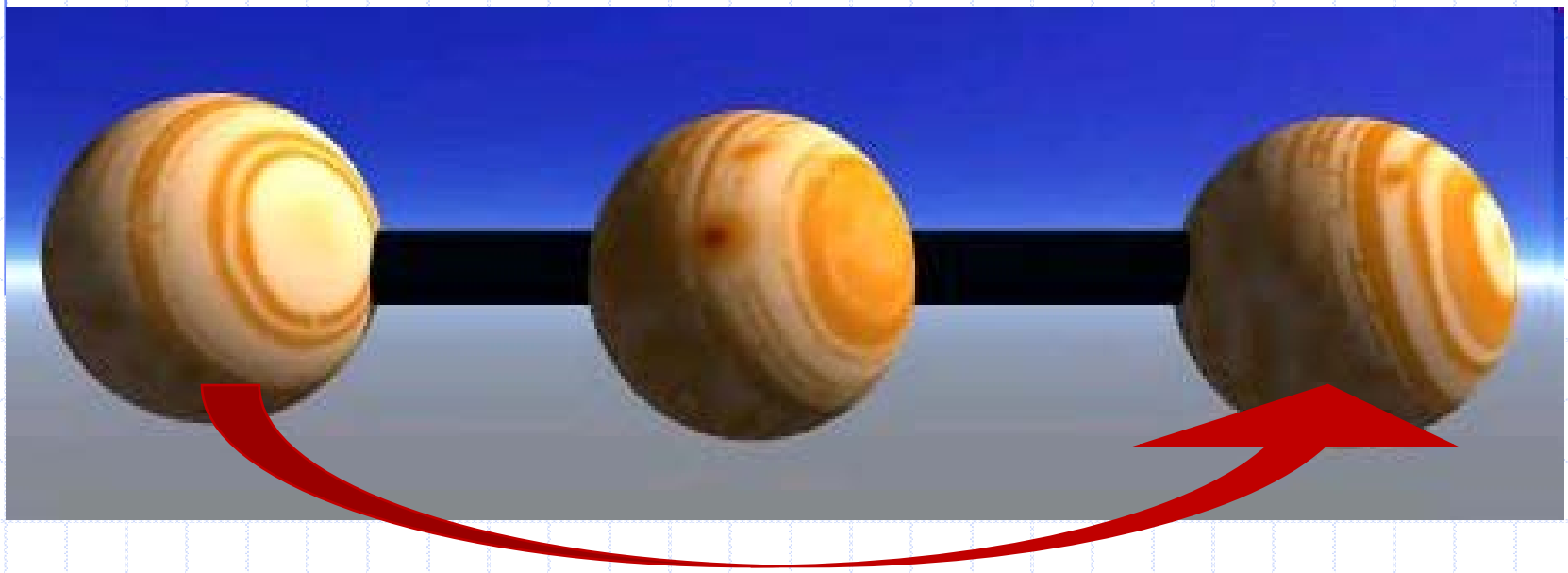
Bonding Geometry!!

- We write in 2D, but molecules are obviously not restricted to such
- In order to determine polarity, bond angles, and geometric shape we need to build, imagine, or interpret 2D representations into the 3D world.

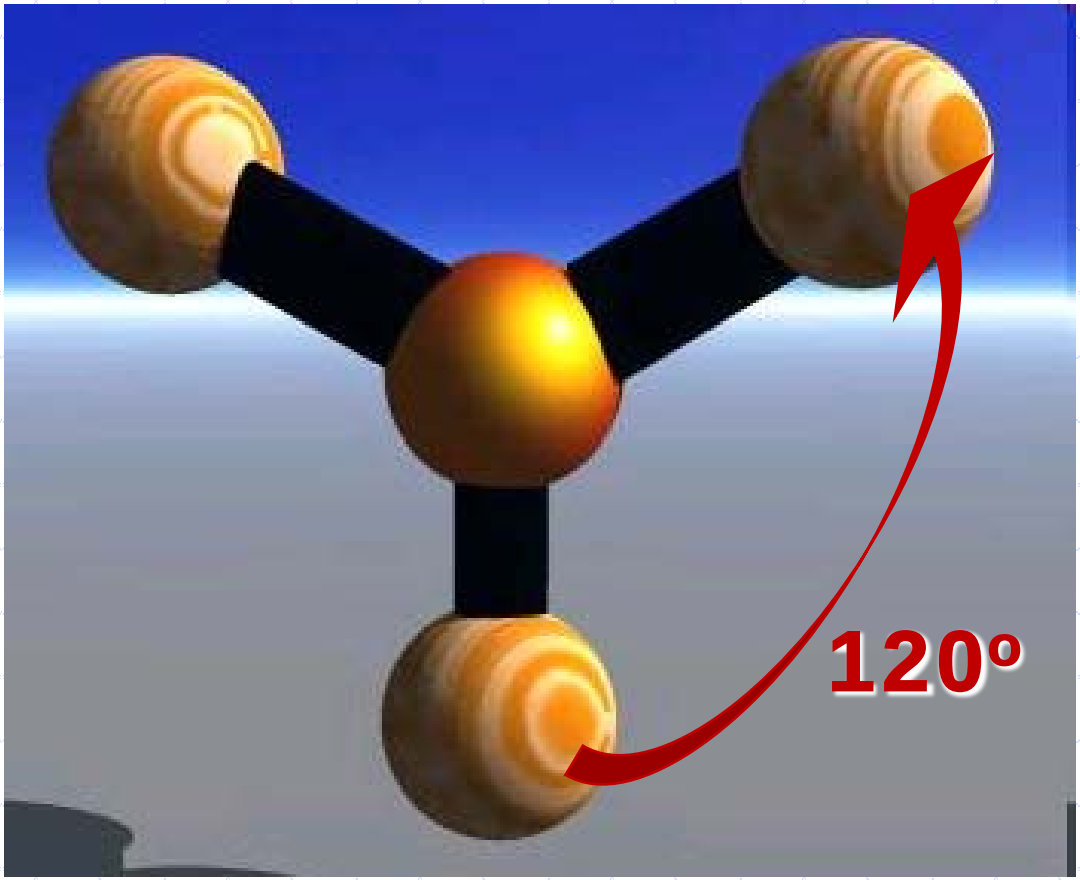
VSEPR - Valence Shell Electron Pair Repulsion Theory

- **VSEPR:** Theory is one method that chemists use to predict the shapes of molecules.
  - This theory predicts that electron pairs, whether involved in bonds or as non-bonding pairs, will adopt a geometry in which they maximize the distance from one another in order to minimize repulsions. This will result in a geometry with the lowest possible energy.

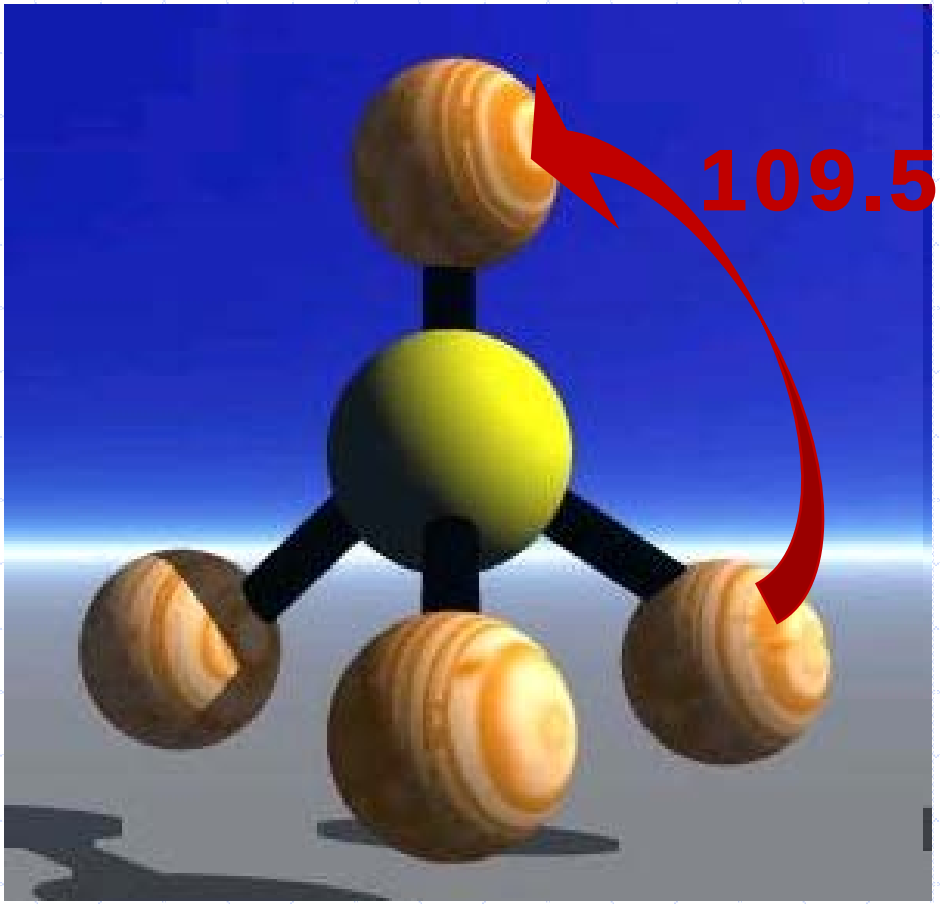
Linear



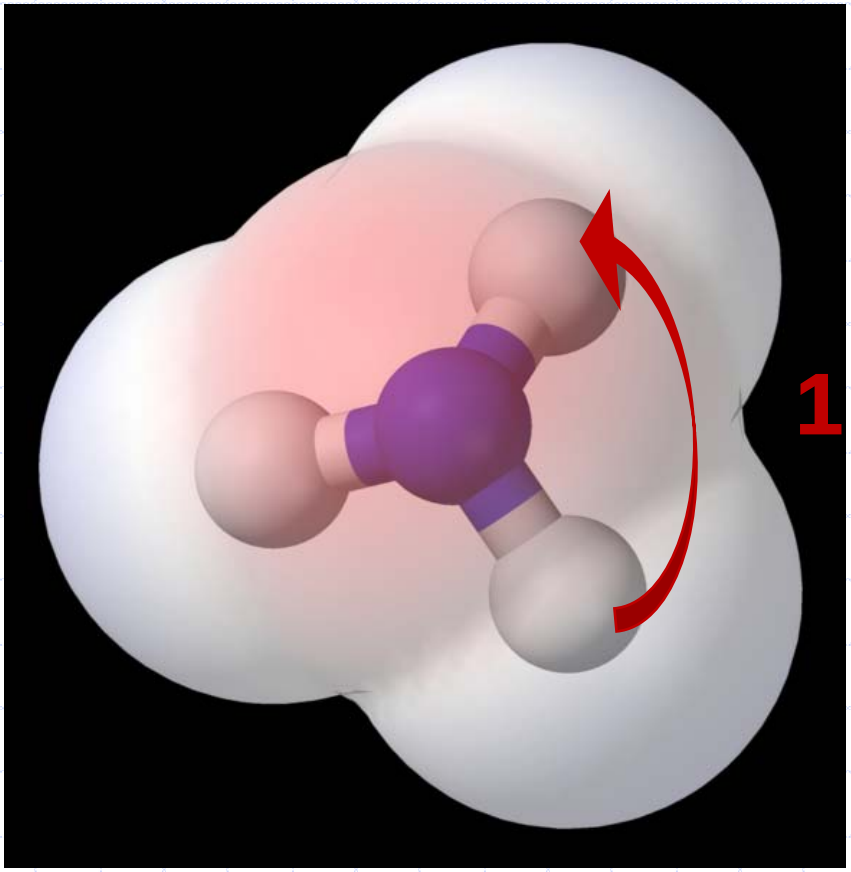
Trigonal Planar



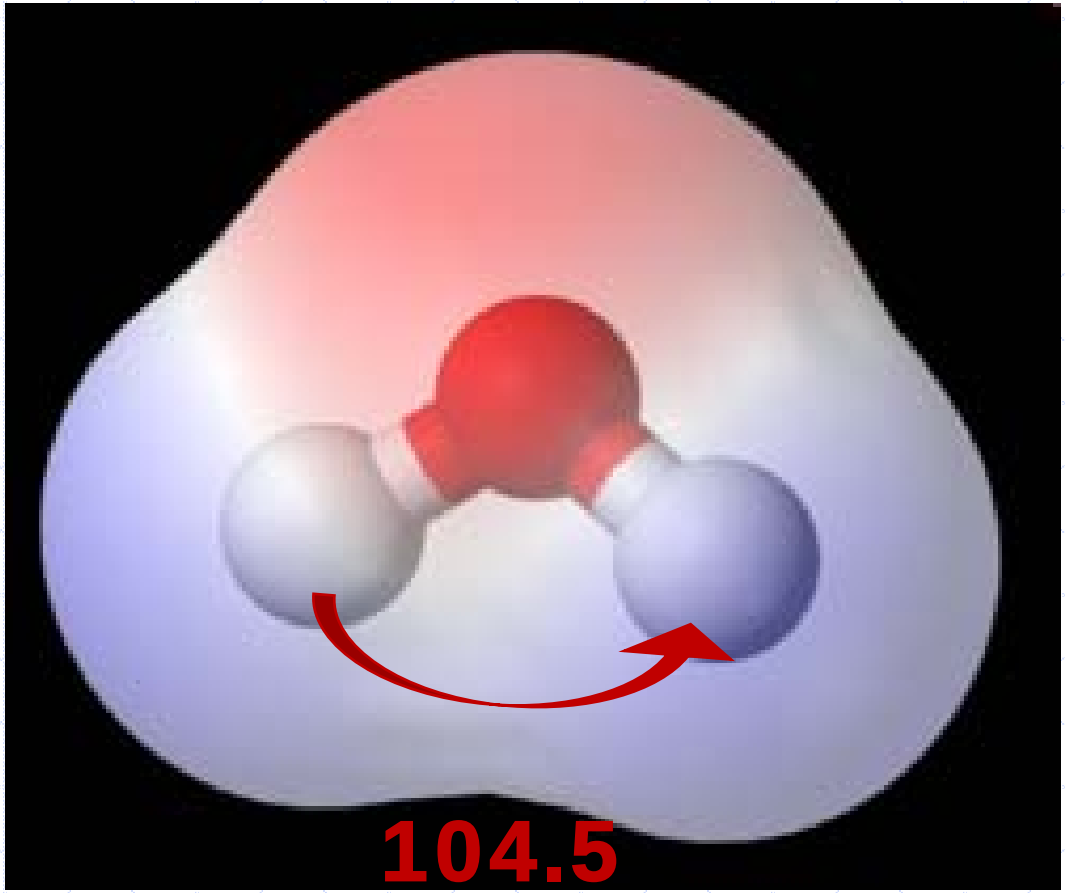
Tetrahedral



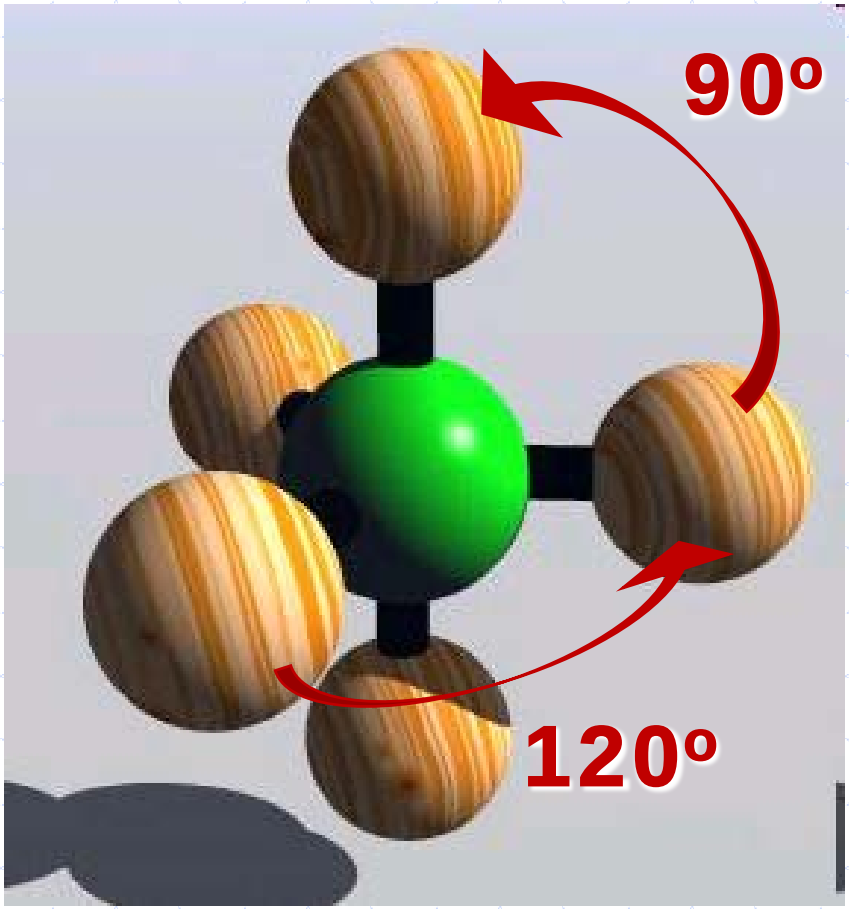
Pyramidal (Tetrahedral)



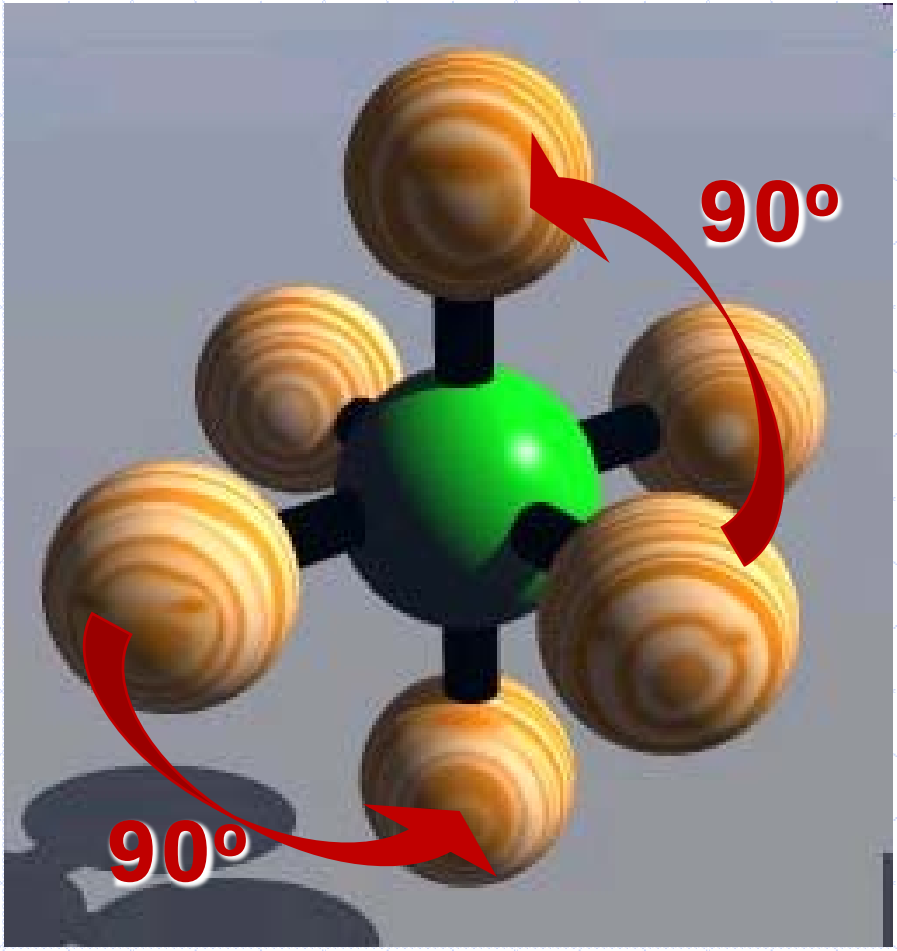
Bent (Tetrahedral)



Trigonal Bipyramidal



Octahedral



Ammonia NH_3 – Polar (uneven)